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VERITAS
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157
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TABLES

OF THE

PRINCIPAL SPEEDS OCCURRING

IN

MECHANICAL ENGINEERING,

EXPRESSED IN METRES, IN A SECOND.

BY

F. KEERAYEFF,

CHIEF ENGINEER OF THE OBOUCHOFF STEEL WORKS, ST. PETERSBURG.

TRANSLATED BY

SERGIUS KERN, M.E., ST. PETERSBURG.

LONDON:

E. & F. N. SPON, 46, CHARING CROSS.

NEW YORK: 446, BROOME STREET.

1879.

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ON

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IN THE ART.

BY N. E. SPRETSON, Es

AUTHOR'S INTRODUC

Until comparatively modern times the manufact
to wrought work: fusible cast iron was an un
valuable properties when in a molten liquid st
In the reign of Queen Elizabeth cast iron was a
works in that material, produced as recently as
present century, show that the ironfounder's art
taken, and cast iron is now applied to a multitud
made from it ranging in size from a half-pint
block, which takes months to cool down after it h
There have been numerous causes at work to
velopment of this important branch of the wo
course, comes the utilization of steam, which, by
port, admitted of the collection of iron ore, fu
separated localities. Steam also gave a great
machinery, in the construction of which cast iron
Improvements in blast engines, a thorough kn
properties of the various ores, and the nature of t
with them, have resulted in the production of a
cast iron, possessing very great fluidity.
To keep pace with the ever-increasing demand
the greatest ingenuity has been used in devising
and ingenious workshop appliances, for dealing w
molten metal; whilst much attention has also be
ments in pattern making, moulding in loam and
which latter branches are, however, only to be
actual experience in the shops, combined with a
of the nature and chemical properties of various m
heat and pneumatics.
Theoretical knowledge is of no service to the

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New York: 446, Broome St

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TABLES

OF THE

PRINCIPAL SPEEDS OCCURRING

IN

MECHANICAL ENGINEERING,

EXPRESSED IN MÈTRES, IN A SECOND.

BY

P. KERAYEFF

CHIEF MECHANIC OF THE OBOUCHOFF STEEL WORKS, ST. PETERSBURG.

TRANSLATED BY

SERGIUS KERN, M.E., ST. PETERSBURG.

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1879.

PREFACE OF THE TRANSLATOR.

Mr. Keerayeff published recently this pamphlet in the Russian language, and it was favourably received by the Engineers of Russia. As the English pocket engineering books give little information on the subject, the translator believes that this small work may be of some use to English Engineers.

Sergius Kern.

St. Petersburg,
December 17th, 1878.

TABLES

OF THE

PRINCIPAL SPEEDS OCCURRING IN MECHANICAL ENGINEERING.

(1) Speed of Belts and Ropes.

Mètres.

1·10. Minimum speed on the periphery of pulleys in using belting.

1·53 Best speed of the motory belt of small benches.

3·05 Best speed of the motory belt of middle-size benches.

5·00–25·00 Speed admissible on the periphery of pulleys in the transmission of motion by ropes and wires.

6·10 Speed of the motory belts of big benches.

9·15 Speed of the motory belts of the largest (giant-like) benches.

(2) Speed of Cutting-tools and Machinery for Metals.

0·015 Mean speed on the periphery while turning the chilled surface of rollers.

0·017 The best mean velocity of the chisel while cutting the channel in steel guns.

Mètres.

0·018 Average speed of scissors.

0·02 Best speed on the periphery of the plate-bending rollers.

0·02 Maximum speed on the periphery while turning plane rollers cast into pig-iron moulds.

0·02–0·032 Speed on the periphery of the channels of cast-iron guns during the turning and drilling of them.

0·025–0·042 Speed on the periphery of channels of steel guns while drilling them, with the constant moistening of the drill by means of potash-water.

0·038 Average speed on the periphery of the drill while cutting screws and nuts from steel on lathes.

0·05 Average speed of broad chisels in grooving rollers for the rolling-mills.

0·05 Average speed of the chisel in the planing or grooving of steel articles on self-acting lathes.

0·05–0·12 Speed on the periphery of steel guns while turning them on lathes.

0·06 Maximum speed of the chisel in turning steam and air cylinders (the inner part). The advancing of the chisel is ¼–1 millimètre on each revolution of the cylinder.

0·06 Average speed of scissors for the cutting of bars of iron and steel into small square pieces used for the reduction of cast steel by melting them in crucibles.

0·06 Speed of the chisel of the moving sledges of big planing benches for mild cast iron and wrought iron.

0·064–0·091 Speed on the periphery of cast-iron guns, cast by the American process, while turning them.

Mètres.

0·08 Average speed on the periphery of steel guns while turning them.

0·08 Mean velocity adopted in turning, planing, and shaping cast-iron articles on self-acting lathes.

0·09–0·11 Speed of the drilling of the channel of copper guns.

0·102 Maximum speed on the periphery of cast-iron articles while grooving them on screw-cutting lathes.

0·102 Maximum speed of the chisel of middle-size planing benches for iron.

0·11 Mean velocity adopted in turning, planing, and shaping wrought-iron articles on self-acting lathes.

0·12 Mean speed of the chisel of small planing, shaping, and drilling lathes for steel articles. The flank moving of the chisel is ordinarily ¼–1 millimètre.

0·13–0·18 Speed on the periphery of copper-alloy guns during the turning of them on lathes.

0·15 Mean speed in drilling copper-alloy screws and nuts.

0·16 Maximum speed on the periphery of steel barrels for rifles while turning them, the drill being constantly moistened with potash-water.

0·17 Maximum speed of the chisel while turning and drilling steel articles on hand lathes.

0·18 Mean speed of the chisel in turning, planing, and drilling of brass articles on self-acting lathes.

0·18 Best speed of drills while drilling rifle-barrels from the two ends at the same time, with the constant moistening of the drills by means of potash-water, under the pressure of 1–1¼ atmosphere.

Mètres.

0·18 Mean speed of the chisel of small planing, shaping, and drilling lathes for cast and wrought iron. The flank motion of the chisel is ordinarily ¼–1½ millimètre.

0·20 Maximum velocity of the chisel while turning and drilling grey, mild pig iron and wrought iron on self-acting lathes.

0·25 Maximum velocity of the chisel for wrought iron on small planing and drilling lathes.

0·30 Maximum speed of the chisel for mild cast iron on hand lathes.

0·38 Mean speed of the chisel of small planing, shaping, and drilling lathes for copper-alloy articles.

0·50 Maximum velocity on the periphery of copper-alloy articles while turning them on self-acting lathes.

0·60 Best speed during the drilling of copper-alloy articles on hand lathes.

0·91 Speed of the band-saw for steel.

1·20 Maximum speed of the chisel in turning copper-alloy articles on hand lathes.

1·50 Maximum speed on the periphery of articles of red copper while turning them on self-acting lathes.

1·52 Velocity of band-saws for iron.

2·00–4·50 Speed of tool-grinding machines.

3·80 Mean velocity on the periphery of iron, steel, and copper articles of big diameters, during the polishing of them by means of emery and oil.

10·00 Mean speed of big grinding stones for the mounting and the polishing of iron and steel articles. Used especially in mechanical works.

Mètres.

15·00 Best velocity of emery polishing and grinding stones (circular).

21·00 Maximum speed on the periphery of polishing wheels and grinding stones.

---

(3) Speed of Wood-working Machinery and Tools.

0·25 Speed on the periphery in turning wood on hand-power lathes.

0·44 Best speed of a chisel in wood-drilling lathes.

1·22 Mean velocity of the drill for wood.

2·40 Mean speed of the moving of the saw-frame with several saws.

3·05–4·60 Velocity of the motion of the horizontal frame with one band-saw.

4·00 Maximum speed of the drill for wood.

4·60 Mean speed in turning articles of small diameter on self-acting lathes.

7·62 Average speed on the periphery of round chisels.

12·20 Speed on the periphery in turning big wooden models on self-acting lathes.

12·20–15·00 Velocity of band-saws for wood.

18·30–30·50 Speed on the periphery of revolving chisels in planing machinery for wood.

25·00–32·00 Velocity of round saws in sawing wood across the fibre.

32·00–40·00 Velocity of round saws in sawing wood along the fibre.

---

(4) Speeds of Rolling-mills.

The speeds here mentioned were calculated, assuming the diameters of the rollers to be the following:—

	Mètres.
For armour plates	0·82
„ boiler plates	0·71
„ thick iron bars	0·66
„ roof iron	0·51
„ rails	0·51
„ mill bars	0·46
„ mean thickness iron bars	0·38
„ small iron bars	0·25
„ wire	0·15–0·20

Mètres.

0·10 Best velocity of rolling-mills for the laminating of metals in cold state.

0·30 Speed of the drawing of thick (0·006 mètre diameter) iron wire.

0·30 Average speed of the revolving hearth of the Pernot steel furnace.

0·52 Speed of the drawing of iron wire of mean thickness (0·003 mètre in diameter).

0·53 Average velocity of the motion of the revolving hearth of the Pernot puddling-furnace.

0·80 Mean velocity on the periphery of the rollers for armour plates and thick ship-plates.

0·90 Velocity of the squeezing rollers for puddling balls.

1·00 Maximum speed during the drawing of thin iron wire (0·001 millimètre in diameter).

1·20–2·00 Speed of rolling-mills for boiler iron plates.

1·50 Speed of tyre-mill rollers.

1·70 Average speed of rolling-mills for rails, round iron (from 8 to 15 centimètres in diameter), square iron (7–13 centim.), and flat iron (47 centim.).

Mètres.

1·70 Average speed of rolling-mills for big angle-iron and T-iron (height up to 18 centimètres).

2·00 Average velocity of rollers for middle-size merchant iron.

2·20 Average velocity of rollers for small-size merchant iron.

2·50 Best speed for the rolling of nail iron and small bars.

4·00 Maximum velocity of rollers for thin iron wire (diameter 4–6 millimètres).

60·00–140·00 Velocity of circular saws for hot iron.

---

(5) Speeds of Pistons and Pump-plungers.

0·30 Mean speed of pump-pistons.

0·75 Maximum speed of pump-pistons (disadvantageous).

1·53 Speed of the piston of steam engines of ordinary velocity.

1·54 Mean velocity of the motion of pistons of mine-pumps.

2·13 Maximum speed of air-pump pistons.

2·23 Speed of the piston of high-velocity engines.

2·30 Average speed of the steam piston in locomotives.

3·60 Maximum velocity of the steam piston in locomotives.

4·06 Speed of the steam piston of the Allen's type engine.

---

(6) Speeds of Fly-wheels.

7·62 Maximum velocity on the hoop of fly-wheels of ordinary engines.

Mètres.

25·00 Average velocity on the periphery of fly-wheels for rolling-mills.
30·48 Maximum speed of fly-wheels for hammers.
36·58 Maximum speed of rolling-mill fly-wheels.
52·50 Maximum theoretical speed allowed on the hoop of fly-wheels.

---

(7) Speeds of Ships, Steamers, and Locomotives.

0·274 Average velocity of the moving of big wagons on rails in mines by man power.
0·55 Average speed of the moving of small wagons on rails in mines by man power.
1·33 Average speed of mountain locomotives.
1·85 Average speed of traction engines on good roads (with elastic wheels).
2·00–3·50 Speed of cars on American tramways.
4·00 Average speed of steamers in dead water.
5·00 Average speed of sea steamers.
6·00 Maximum speed of mountain locomotives.
9·00 Maximum speed of heavy locomotives for conveying goods.
12·00 Maximum speed of mixed trains.
12·00 Maximum velocity of passenger mountain-locomotives and of American river steamboats.
15·00 Maximum speed of an ordinary passenger-train.
25·00 Maximum velocity of fast passenger-trains in England and Germany. (Express and der Schnellzuge.)

---

(8) Speeds of Lifts and Pumps.

Mètres.	
0·05	Average speed of coke-dragging hand-power machine for coking-furnaces (kilns).
0·102	Best speed of the lifting weight for winches with mechanical motion (for weights about 2 tons).
0·127	Maximum speed of hoisting by a double hand-power winch.
0·14	Average speed of steam-power coke-dragging machine for coking-kilns.
0·24	Best speed of dredging-machine buckets.
0·82	Maximum speed of assorting drums for ores.
0·914	Average speed of steam-power hoists in mines.
0·95	Average speed of farkunsts (platform for the lifting of men in mines).
2·03	Average velocity of steam lifting of wagons from shafts 420 feet deep, load 1 ton.
4·00	Ditto for shafts 840 feet deep, load 2 tons.
6·09	Ditto for shafts 1500 feet deep, load 2 tons.
10·00	Ditto for shafts 3200 feet deep, load 2 tons.
11·50	Best speed on the periphery of the wooden wings of Rout's ventilator.
12·00	Maximum speed of the hoisting of wagons in shafts.
25·00	Average velocity of wings of an ordinary air-drawing ventilator.
50·00	Average speed on the wings of air-blowing ventilator.

---

(9) Speed in preparing Mineral Ores.

0·04	Speed of ascending stream of water, during which coal pieces of irregular form which passed through the holes of sifting drums 1 millimètre in diameter, cannot fall down.

Mètres.	
0·06	Speed, &c., for holes 2 millimètres in diameter.
0·07	Ditto, for 3 millimètre holes.
0·08	Ditto, for 4 millimètre holes.
0·10	Ditto, for 6 millimètre holes.
0·10	Ditto, for 1 millimètre holes, as applied to quartz in grains.
0·102	Maximum speed of the falling of coal pieces 1 millimètre in diameter in dead water.
0·12	Speed of ascending stream of water when coal pieces passing 8 millimètre holes cannot fall down.
0·13	Ditto for 10 millimètre holes.
0·14	Ditto for 2 millimètre holes, as applied to quartz grains.
0·15	Maximum speed of a stream of water, during which fat clay is not carried away by the stream (Telford).
0·1766	Maximum speed of the falling of the carbonaceous limestone (diameter of pieces 0·001 mètre).
0·19	Speed of ascending stream of water when irregular pieces of quartz passing 4 millimètre holes cannot fall down.
0·2044	Maximum speed of the falling of coal pieces 4 millimètres in diameter in dead water.
0·3536	Ditto, applied to carbonaceous limestone (diameter 4 millimètres).
0·409	Maximum speed of fall of pieces of coal 0·016 mètre diameter in dead water.
0·63	Maximum velocity of water in rivers when the precipitated roundish, coarse sand is not carried away by the stream.
0·707	Maximum speed of the fall in dead water of carbonaceous limestone in pieces 0·018 mètre in diameter.

Mètres.

0·82 Maximum speed on sifting drums during the enriching of ores.

0·92 Maximum velocity of water during which roundish stones are not carried away by the stream.

1·22 Ditto applied to stones of irregular form.

1·53 Ditto applied to conglomerates and slate-clay. (Telford.)

---

(10) Speeds of Flour and Oil Mills, Reaping Machines, and Disintegrators.

0·23 Average speed of sack-winch for the lifting of grain.

0·30–0·90 Speed of the crushing rollers.

0·32 Speed of the crushing roller used in preparing malt.

0·47 Best speed for the ore-crushing rollers.

0·50 Mean speed of elevators for grain, flour, pearl-barley.

0·70 Mean speed of rollers for the squeezing of oil out of seeds.

0·80 Maximum velocity of elevators for grain.

1·12 Average velocity of cylindrical sieves (six-sided section) for the cleaning of grain from dust and dirt.

1·20 Ditto applied to flour cleaning.

2·20 Best velocity of the knife of reaping machines.

2·44 Maximum speed during which light oat flour, &c., may be transferred by the means of endless linen without being dispersed by the arising, in this case, air currents.

2·75 Ditto applied to heavy grains.

6·50–10·00 Velocity on the outer periphery of millstones.

Mètres.
40·00–60·00 Speed of disintegrators for hard materials.

---

(11) SPEED OF WATER, AIR, GAS, AND STEAM.

0·15 The best advantageous velocity of water in channels with clay bed.
0·30–4·00 Speed of air during a feeble wind.
0·45 Mean velocity of rivers with feeble flow.
0·90 Mean velocity of water flowing on water-wheels in fabrics.
1·00 Flow of water in sucking and pressing tubes of single-action pumps.
1·067 Maximum speed of air through the fire-grate of boilers.
1·22 Average speed of rivers with mean flow.
1·372 Maximum speed of air passing the fire-grates of steamer-boilers.
1·60 Speed of water advantageous in sucking-tubes of double-action pumps.
2·13 Average velocity of rivers with quick water flow.
3·05 Average speed of the motion of gases in chimneys.
3·50 Best velocity for illuminating gas in pipes.
4·00–7·00 Velocity of air during moderate wind.
5·49 Average velocity of gases in chimneys with artificial draught.
6·40 Maximum speed of air in the sucking valves of air pumping machines.
7·00–11·00 Speed of air during fresh wind.
7·62 Speed of air admitted in the erection of windmills.

Mètres.

10·00 Best speed of the motion of air in pipes of air blowing engines.

11·00–17·00 Speed of air during strong wind.

12·80 Maximum speed of air in air-pressing valves of blowing engines.

14·80 Flow of the gas from a burner (pressure of water 0·45–0·50 inch).

17·00–28·00 Speed of air during tempests.

35·70 Ditto during hurricanes.

44·70 Ditto during hurricanes drawing out trees.

343 Velocity of steam under the pressure of 1·5 atmosphere entering freely into the air.

395 Velocity of air under a pressure of 1 atmosphere entering into a vacuum.

500 Velocity of steam under 3 atmospheres entering freely into the air.

562 Ditto applied to steam under 5 atmospheres.

582 Velocity of steam under 1 atmosphere entering freely into a vacuum.

---

(12) Speed of Animal Powers.

0·16 Speed of a man going up a ladder without a load, during 8 hours' work.

0·22 Average speed of lifting a load by man by means of an immovable pulley.

0·28 Average speed of the motion of a hand-cart with a load on an inclined surface ($\frac{1}{12}$).

0·51 Mean speed of a workman bringing a load and coming back freely.

0·75 Speed of working a hand-pump.

0·75 Speed of a man with a load on his shoulders.

Mètres.

0·80 Velocity of an ass driving a windlass.
0·90 Ditto applied to a horse.
1·10 Speed of man using a lever.
1·22 Velocity of a heavy horse without load.
1·32 Speed of a German infantry soldier with a load of 20 kilogrammes (108 steps in a minute; length of every step 0·732 mètre).
1·50 Average speed of a man without load on horizontal places.
4·42 Speed of a post-horse with a load of ½ a ton, making 12 to 13⅓ miles in 24 hours.
18·00 Average speed of post-pigeons.

---

(13) Velocity of Sound, Light, and Electricity.

332·77 Speed of sound in free dry air at 0° Celsius.
1435 Velocity of sound in water at 9° Celsius.
2550 Speed of sound in tin.
3060 Ditto in silver.
3400 Ditto in cast iron.
3628 Ditto in brass.
3628 Ditto in oak.
4080 Ditto in red copper.
4250 Ditto in beech-wood.
4896 Ditto in elm and ash-tree.
5100 Ditto in linden-wood.
5440 Ditto in pine-wood.
5668 Ditto in iron, steel, and glass.
6120 Ditto in red-fir wood.
(11·69) . 10^6 Velocity of voltaic currents in telegraphic circuits.

Mètres.	
$(18{\cdot}4) \cdot 10^6$	Velocity of induction currents in telegraphic circuits.
$(298) \cdot 10^6$	Velocity of light determined by using terrestrial sources of light.
$(463{\cdot}5) \cdot 10^6$	Velocity of the current of electricity received through the discharge of a leyden jar, in using a copper wire 1·70 millimètre in thickness.

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PLATES.
, 15, 16. Reverberatory, or Air Furnaces, for smelting cast iron, bronze, and brass.
17. Mohr's Pyrometer.
18. Cavatelli's Differential Expansion Pyrometer.
18a. Wilson's Pyrometer.
19. Bayley's Differential Expansion Pyrometer.
20. Siemens' Electrical Pyrometer.
21, 22. Crucible Moulding Machine.
, 24, 25. Common Fanned Blowers; Schiele's, Lloyd's, Aimé's, Sturtevant's, Greyson's, Baker's, and Root's.
26, 27. Pattern-making Machine Tools, Face Lathes, Glue Ovens, and the like.
28. Trowels, Slickers, Cleaners, Rammers, and other Flat and Hollow Moulding Tools.
29, 30. Flat Moulding, Casting on.
31. Hollow Moulding, Cart-wheel Bushes, Cast-iron Kettles.
32, 33. Jobson's Moulding Blocks in all stages; Flask used for the process.
34, 35. Heavy Green-sand Moulding.
6, 37, 38. Moulding Shell, Pulleys and Undercut Work, Pipe Flask.
39, 40. Pipe Moulding, Pipe Cores, Core Bars, Loam Boards, Trusses, and Skeleton Cores.

PLATES.
41 to 44. Pipe Moulding Jobson's Machine, Wood Dobbie's Machine.
45 to 47. Loam Moulding pans; Sir Cylinders.
48. Plate Moulding
49. Chill Moulds.
50. Hood's Core Fairness.
51 to 56. Wheel Mo Wheel-mou nery, Hop strikers and ing Wheel Scott and Wheel-mou chines.
57 to 61. Foundry Cran
62 to 72. Quick-runni Rope, Wire Overhead Cranes.
73. Foundry Ladle of conveyan
74, 75. Emery Wheel ing Machi
76. Crucible Steel employed Sheffield
77, 78. Estimate She
79. Wheel Turnin U.S.A. Che
80. Plan and Howard's the Agricu Works, Bed
81, 82. Plan and V Foundry a heavy Engi Miscellaneo Notes at Ba

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